REMARKS

In the Office Action dated April 12, 2005, the Examiner rejected claims 19, 22, 24, and 26-28 under 35 USC 102(e) as anticipated by Nishiguchi (US Patent 5,214,308), rejected claim 23 under 35 USC 103 as unpatentable over Nishiguchi, rejected claims 20 and 25 under 35 USC 103 as unpatentable over Nishiguchi and Kato (US Patent 6,486,562), rejected claim 21 USC 103 as unpatentable over Nishiguchi and Morihara (US patent 5,495,439), rejected claims 29-31 under 35 USC 103 as unpatentable over Nishiguchi, rejected claims 32-34 under 35 USC 103 as unpatentable over Nishiguchi and Chiu (6,391,683), rejected claims 35, 36, 39, 37 under 35 USC 103 as unpatentable over Nishiguchi and Holzapfel (US Patent 5,872,633), rejected claim 38 under 35 USC 103 as unpatentable over Nishiguchi, Holzapfel, and Kato (US Patent 6,486,562), rejected claims 40-42 under 35 USC 103 as unpatentable over Nishiguchi and Holzapfel and rejected claim 43 as unpatentable over Nishiguchi, Holzapfel, and Chiu (US Patent 6,391,683). In response thereto, the Applicants have amended claim 19. Claims 19-43 remain at issue.

The Art Rejection

The claims have been amended to positively recite that: (i) the underfill adhesive has edges that are cut around the periphery of the flip chip; and (ii) the underfill material is applied directly to the active surface of the flip chip integrated circuit.

In contrast, the Nishiguchi reference teaches the filling of the gap between a semiconductor device and a substrate with a bonding agent ***after*** the semiconductor device is mounted onto the substrate. Specifically, column 3 lines 46-52 state:

> Instead of molting the bump 2, insulative bonding agent which contracts when it cures may be **filled into a gap between the semiconductor device 1 and the substrate 3** and the bump 2 may be pushed to the electrode terminal 5 by a curing contraction force of the bonding agent to electrically connect the bump 2 to the electrode terminal 5. (emphasis added)

The bonding agent at the edges of the Nishiguchi reference are therefore not: (i) cut; or (ii) applied directly to the active surface of the die. Since the underfill material is applied to the flip chip of the present invention while in wafer form and then cut during the dicing operation, the edges of the die have clean "cut" straight vertical surfaces. In contrast, the underfill material of Nishiguchi would have uneven, non-straight surfaces since the material is dispensed between

the chip and the printed circuit board and then allowed to flow randomly before curing. Furthermore, the filling of the gap between the device and substrate of Nishiguchi is not the same as applying underfill adhesive directly to active surface of a flip chip.

Claim 19 has also been amended to remove the product by process language "during a dicing operation" from the claim. The claim now recites only physical limitations of the flip chip (i.e., "cut edges"), which is not taught or suggested by the prior art.

The Applicants submit that claims 19-34 are therefore allowable.

In the "*Response to Arguments*" with regard to claim 35, the Examiner states:

> *With regard to the applicants' argument that claim 35 is directed to a semiconductor* ***wafer*** *with a layer of at least partially cured underfill on the active surface, note that during curing the process of the underfill of the Nishiguchi reference, the underfill is partially cured.* (emphasis added)

A review of this statement indicates that the Examiner fails to appreciate the scope of claim 35 and has misconstrued the Nishiguchi reference. The claim is directed to a semiconductor wafer, not an individual die that has been presumably scribed from a wafer and placed on a printed circuit board. Nishiguchi specifically teaches that the underfill material is applied between the chip and the board only after the chip has been mounted to the board. Nishiguchi therefore teaches away from the present invention, which is directed to applying the underfill material onto a wafer before the individual flip chips are mounted to a printed circuit board.

Another advantage of the present invention is that the underfill adhesive is applied simultaneously onto all the chips of a wafer and then cured. In contrast, Nishiguchi teaches the "*filling*" of the underfill only after an individual chip has been mounted onto a printed circuit board. Once the underfill material is disposed between the chip and printed circuit board, it is allowed to cure. In contrast with the present invention, the underfill is applied and cured on all the chips on a wafer. The wafer is then scribed or cut, singulating the individual chips. The chips can then be mounted directly onto a printed circuit board, eliminating the need to fill the gap between the chip and the board with underfill and then curing the underfill, as taught by Nishiguchi.

The Applicants submit that claim 35 is allowable. Claim 35 is directed to a semiconductor ***wafer*** with a layer of at least partially cured underfill adhesive formed on the active surface. As previously noted, Nishiguchi teaches the filling of the gap between a semiconductor device and a substrate with a bonding agent. Nishiguchi therefore explicitly teaches that the bonding agent is applied subsequent the semiconductor device being mounted onto the substrate.

Holzapfel is directed to a polishing machine for removing layers from a wafer. There is absolutely no reason whatsoever to combine these references. In fact, the two references seem to contradict one another, and therefore can not be combined as the Examiner suggests. One is directed to forming a layer (bonding agent) onto a single semiconductor device. The other is directed to removing layers from the surface of a wafer.

The Applicants submit that claim 35 is therefore allowable. Although patentable in their own right, claims 36-37 are also allowable based on their dependency on claim 35. Finally, although not specifically addressed herein because it is believed not necessary, the Applicants disagree with the Examiner's reasons for rejecting claims 36-37. The Applicants failure to substantively address these rejections should not be construed in anyway as an admission by the Applicants as to the veracity of these rejections. The Applicants reserve the right to address these rejections at anytime in the future.

Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
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